

Accordingly, applicants respectfully request withdrawal of the rejection of Claims 7-9.

The Rejection of Claims 1-9 Under 35 U.S.C. § 103(a)

Claims 1-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamayachi et al. (U.S. Patent No. 4,943,516) in view of Wolski et al. (U.S. Patent No. 5,447,619).

Applicants respectfully disagree. Before references can be combined or modified, first, there must either be a teaching or a suggestion, either in the references or in the knowledge that is generally available, to modify a reference or to combine references. Second, there must be a reasonable expectation of success. Third, all of the claim limitations must be taught or suggested by the prior art references. Claims 1, 4, and 7 are the independent claims. The remainder of the claims depend from either one of Claims 1, 4, or 7. Each of Claims 1, 4, and 7 is related to a process for forming a solder resist pattern, comprising, at least, pretreating a printed circuit board, laminating a thermosetting film on the printed circuit board, and irradiating a laser beam to the laminated thermosetting film according to a solder resist mask pattern to selectively remove the thermosetting film.

The Examiner states that "Kamayachi et al. remain silent about the pretreating the printed circuit board before lamination step."

The Examiner states that "Wolski et al. teach that it widely accepted practice in the manufacturing of printed circuit board (PCB) to pretreat or clean or microetch the circuit board using abrasion, scrubbing or chemical means for increasing bonding capability between the circuit patterns in the copper-clad laminate and polymeric resist material (col. 4, lines 52-col. 5, lines 14)."

Based on this, the Examiner concludes "it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Wolski et al's teaching into Kamayachi et al's process for increasing bonding capability between the circuit patterns in the copper-clad laminate and polymeric resist material as taught by Wolski et al."

Before references can be combined, there has to be some motivation for doing so. Applicants submit that the Examiner has not fully appreciated the teachings of the references. The Examiner has only looked to a narrow passage in Wolski et al. However, the entire reference must be considered to fully comprehend what the reference as a whole teaches. Applicants submit that Wolski et al. does not teach or suggest that circuit boards need to be pretreated. Wolski et al. states the opposite. Wolski et al. teaches that "roughening" techniques, both mechanical and chemical, are complicated and expensive, and produce negative effects. See Col. 10, lines 20-29. The invention of Wolski et al. obviates the need for roughening

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techniques when laminates for MLBs (multiple layer circuit boards) are prepared matte side up. Accordingly, applicants submit the teaching of Wolski et al., as a whole, is to avoid "roughening" the surface of a circuit board prior to lamination. Accordingly, Wolski et al. teaches away from the claimed invention.

Applicants further submit that even if Kamayachi et al. is combined with Wolski et al., the combination does not result in all the claim limitations being taught or suggested. Applicants respectfully submit that the Examiner has mischaracterized Kamayachi et al. Specifically, Col. 1, lines 7-20, of Kamayachi et al. does not teach or suggest irradiating a laser onto a thermosetting film according to a solder resist mask pattern. Applicants submit that Col. 1, lines 7-20, describes exposing a layer of resin composition selectively to an actinic ray through a photomask having a pattern and developing the unexposed part of the layer. The Kamayachi et al. reference describes in Col. 16, lines 9-15, what is meant by "actinic ray." "The coating thus formed on the board is then directly exposed to a laser beam or selectively exposed through a photomask having a prescribed pattern to the actinic ray from a high-pressure mercury-vapor lamp, ultra-high-pressure mercury-vapor lamp, a metal halide lamp, a chemical lamp, a xenon lamp, or the like." Thereafter, the unexposed portion of the coating is developed with the developing solution to give rise to a resist pattern. In the invention of Claims 1, 4, and 7, the laser beam is irradiated onto the laminated thermosetting film to selectively remove the thermosetting film. Thus, the claimed invention advantageously eliminates the further step taught in Kamayachi et al. of developing unexposed portions with developing solution to give rise to the solder resist pattern. If neither Kamayachi et al. nor Wolski et al. teaches or suggests irradiating a laser beam to the laminated thermosetting film according to a solder resist mask pattern to selectively remove the thermosetting film, the claims are not rendered obvious.

Accordingly, applicants respectfully request the withdrawal of the rejection of Claims 1-9.

The Rejection of Claims 1-9 Under 35 U.S.C. § 103(a)

Claims 1-9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Paulus (U.S. Patent No. 5,626,774) in view of Wolski et al. (U.S. Patent No. 5,447,619).

Applicants respectfully disagree. Applicants respectfully submit there is neither a suggestion nor motivation to combine or modify references, and, furthermore, all the claim elements are neither taught nor suggested by the prior art references.

The Examiner states that "Paulus remains silent about the pretreating the printed circuit board before lamination step."

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The Examiner states that "it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Wolski et al's teaching into Kamayachi et al's process for increasing bonding capability between the circuit patterns in the copper-clad laminate and polymeric resist material as taught by Wolski et al."

Applicants respectfully submit that the Examiner has failed to fully appreciate the teachings of the prior art references. Based on this erroneous characterization, the Examiner's rejection of Claims 1-9 is untenable.

Paulus describes a four-layer printed circuit board between two outer layers. The outer layers are the copper foil 24 coated with two layers of epoxy resin 26 and 28. The inner layer 26 preferably is substantially completely cured (C-staged) so that it serves as a uniform protective layer on the circuit board after the copper has been removed. The outer layer 28 is partially cured (B-staged) so that it remains free to flow around the raised circuit features and to serve as an adhesive. The coated copper foil 24 and four-layer circuit board are laminated using heat and pressure. The solder mask will be layer 26. Therefore, to form the solder resist pattern from layer 26, the copper foil 24 first needs to be removed. To this end, the copper foil 24 surface is covered with an etch resist layer 30. The etch resist layer 30 is photocured using a mask that allows only the region to be accessed to remain unexposed. When the unexposed (uncured) etch resist is contacted with a suitable solvent, such as sodium carbonate solution, the underlying epoxy layer can be exposed, while the remaining copper layer 24 is protected by the cured portion of the etch resist layer 30. Paulus, therefore, provides a method of forming a solder mask having many steps, including adding a copper layer 24 on top of the solder mask layer 26, and an etch resist layer 30 on the copper foil layer 24, removing the etch resist, and removing the copper foil. As shown in the figures of Paulus, the solder mask 26 is applied in FIGURE 18, which is followed by applying copper 24, and the etch resist 30 on top of the solder mask 26. In direct contrast, the invention of Claims 1, 4, and 7 provides irradiating a laser beam to the laminated thermosetting film according to a solder resist mask pattern to selectively remove the thermosetting film. Thus, the claimed method advantageously omits, at least, the further steps taught in Paulus of adding etch resist layer 30, curing the etch resist layer 30, and dissolving the unexposed portions of the etch resist layer 30 with a solvent. Accordingly, Paulus does not teach or suggest the method of the present invention. The Paulus reference also does not teach or suggest pretreating the printed circuit board prior to lamination. As discussed above, Wolski et al. teaches away from pretreating a surface prior to lamination. At Col. 10, lines 22-25, Wolski et al. teaches "pretreating" is a detriment, because "roughening" techniques affect the

dimensional stability of thin laminates that leads to lower quality products. Therefore, there is no motivation or suggestion to combine Wolski et al. with Paulus.

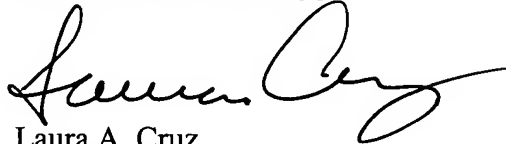
Accordingly, applicants respectfully request the withdrawal of the rejection of Claims 1-9.

CONCLUSION

In view of the foregoing remarks, applicants respectfully submit that Claims 1-9 are in condition for allowance. If the Examiner has any further questions or comments, the Examiner is invited to contact the applicant's attorney at the number provided below.

Respectfully submitted,

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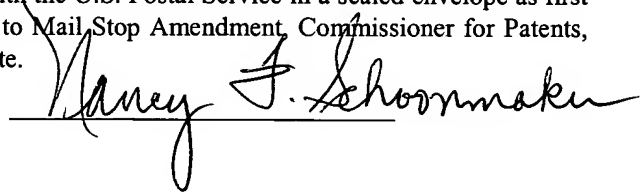
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